

BACKGROUND

Proteins and DNA are information rich molecules with structural and electrical properties which make their incorporation into the human manufacturing arsenal an attractive proposition. Several microstructures using oligonucleotides as building blocs have been demonstrated (N. C. Seeman, *Ann. Rev. Biophys. Biomol. Struc.*, vol. 27, pp. 225, 1998; E. Winfree, F. Liu, L. Wenzler, and N. C. Seeman, *Nature*, vol. 394, pp. 539, 1998.), and many particles/objects have been derivatized with DNA strands or oligonucleotides (R. Bashir, "DNA-Mediated Artificial Nano-Bio-Structures: State of the Art Future Directions," *Superlattice and Microstructures*, vol. 29, pp. 1-16, 2001.) Short strands of DNA, also known as aptamers have been suggested as a tool in DNA mediated self assembly of micro components into larger subassemblies or onto a PC board (C. F. Edman, C. Gurtner, R. E. Formosa, J. J. Coleman, and M. J. Heller, "Electric-Field-Directed Pick-and-Place Assembly," *HDI*, vol. October, pp. 30-35, 2000; C. F. Edman, R. B. Swint, C. Gurtner, R. E. Formosa, S. D. Roh, K. E. Lee, P. D. Swanson, D. E. Ackley, J. J. Coleman, and M. J. Heller, "Electric Field Directed Assembly of an InGaAs LED onto Silicon Circuitry," *IEEE Photonics Tech. Lett.*, vol. 12, pp. 1198-1200, 2000; C. A. Mirkin, R. L. Letsinger, R. C. Mucic, and J. J. Storhoff, *Nature*, vol. 382, pp. 607, 1996.). Proteins have also been used in a wide variety of microstructures with motor proteins perhaps the most studied example. The first examples of combinations of proteins with micromachined structures were realized recently. One example of this hybrid human/natural manufacturing trend is a Ni rotor blade affixed to a motor protein. (Montemagno at Cornell, <http://www.sciam.com/explorations/2000/112700nano/>).